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AUTHOR	Guthrie, John T.
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ABSTRACT

A 5x2x2 factorial design, including 4 instructional treatments and a control group, 2 levels of socioeconomic status (SES), and 2 levels of IQ, was used to study methods for facilitating the formation of a one-dimensional language concept. The concept formation task required the production of instances of the concept embedded in sentences. The treatments were: rule verbalization (RV), rule application (RA), production of instances of the concept (P), and no training (NT). Subjects (Ss) were 75 Negro fifth and sixth graders run individually. The analysis of variance and post hoc comparisons indicated that treatments RA and P did not differ in effectiveness and both were significantly more effective than treatment RV. RV was significantly superior to NT. The high SES group learned in significantly fewer trials than the low SES group in all treatments except NT. On a mastery test requiring the production of instances of the concept embedded in sentences, the Ss who had attained criterion on the concept attainment task were superior to both the Ss who had failed to learn and the control group which received only the mastery test. The latter two groups did not differ significantly. These results indicate that concept formation is facilitated by the same instructional procedures for both high and low SES Ss. (Author)

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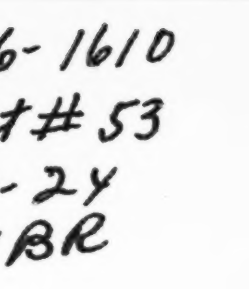

THE JOHNS HOPKINS UNIVERSITY

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THE CENTER FOR THE STUDY OF SOCIAL ORGANIZATION OF SCHOOLS

EFFECTS OF INSTRUCTION AND SOCIOECONOMIC STATUS ON CONCEPT LEARNING IN CHILDREN

BY

JOHN T. GUTHRIE

OCTOBER 1969

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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The Johns Hopkins University
Baltimore, Maryland

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FOREWORD AND ACKNOWLEDGMENTS

The author is indebted to Dr. Thelma Baldwin and Dr. Catherine Garvey of the Program for the Study of Standard Language Acquisition who contributed able assistance and advice to this project. Appreciation is also expressed to Mr. Paul McFarlane who collected much of the data on which this report is based. The cooperation of the Baltimore City Schools and the assistance of the principals and teachers affiliated with this project are gratefully acknowledged.

The Program for the Study of Standard Language Acquisition is concerned with the means by which children who are speakers of a nonstandard variety of English may acquire a command of spoken standard English. The research reported here is a part of the effort devoted to the improvement of instruction of oral language training and is particularly relevant to the design of instructional sequences.

ABSTRACT

A 5x2x2 factorial design, including 4 instructional treatments and a control group, 2 levels of socioeconomic status (SES), and 2 levels of IQ, was used to study methods for facilitating the formation of a one-dimensional language concept. The concept formation task required the production of instances of the concept embedded in sentences. The treatments were: rule verbalization (RV), rule application (RA), production of instances of the concept (P), and no training (NT). Seventy-five Negro fifth and sixth graders were run individually. The analysis of variance and post hoc comparisons indicated that treatments RA and P did not differ in effectiveness and both were significantly more effective than treatment RV. RV was significantly superior to NT. The high SES group learned in significantly fewer trials than the low SES group in all treatments except NT. No significant interactions occurred. On a mastery test requiring the production of instances of the concept embedded in sentences, the Ss who had attained criterion on the concept attainment task were superior to both the Ss who failed to learn and the control group which received only the mastery test. The latter two groups did not differ significantly. These results indicate that concept formation is facilitated by the same instructional procedures, the presentation of rules and the application of rules, for both high and low SES Ss.

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Introduction

It has been amply demonstrated that children with low socioeconomic status typically have lower scores on IQ tests than children with a higher socioeconomic status (SES). Indeed, in a review of the literature on this issue, Jensen (1969) reports that the correlation between SES and IQ falls between .35 and .40 in most studies.

In view of the evidence for the genetic basis of intelligence (Jensen, 1969), it is undoubtedly important to control the factor of race in the examination of the relationship between SES and IQ. Toward this end, Lesser, Fifer, and Clark (1965) have administered tests of verbal, reasoning, number, and spatial abilities to a variety of ethnic groups. The authors' population included Chinese, Negro, Jewish, and Puerto Rican children. Although the patterns of ability were strikingly different for the different ethnic groups, the higher SES individuals were superior to the lower SES individuals on all abilities. This difference was maintained in all of the ethnic groups.

In addition to difference in IQ among different SES groups, John (1963) has found that the vocabularies of low SES Negro children are considerably smaller than the vocabularies of middle SES Negro children. Furthermore, there is evidence that low SES Caucasian children are inferior to middle SES Caucasian children on both measures of vocabulary and tests of ability to identify verbal analogies (Siller, 1957). The interpretation which has been given to these findings by most investigators is that the capacity of low SES children for abstract verbal functioning is severely limited in comparison to their middle SES peers.

In contrast to the difference between the low and middle SES groups on tests of intelligence and vocabulary, it has been argued that there is no difference between the two SES groups on basic associative learning ability (Jensen, 1969). When Caucasian children from 8-12 years of age are required to learn a list of arbitrarily associated word pairs, there is no difference between low and middle SES groups (Rapier, 1968). Moreover, it has been found that the performance of Negro children on these paired associate learning tasks is independent of the SES of the Ss (Jensen, 1968).

A second type of task which may measure basic associative learning ability is the concept formation task. In this type of task there are a relatively large number of stimuli which must be classified into a relatively few number of response categories. There are many cues in each stimulus which may be used for the classification. The learner's problem is to identify the relevant cues and associate these cues with the correct response categories. Typically, a considerable number of trials is required to master the system and feedback is provided to the learner on every trial.

There have been several comparisons of the concept formation ability of low and middle SES groups. In all of these studies the Ss have been required to classify stimuli consisting of geometric forms. Scholnik, Osler, & Katzenellenbogen (1968) examined 288 Caucasian children aged 5 to 9 characterized as middle and low SES based on the occupation of the main breadwinner in the family. There were no differences attributable to SES, and SES did not interact with any other variable in the study. This finding may have resulted from the fact

that the measure of SES was too insensitive to manifest actual differences. However, the fact that the SES measure was sensitive enough to produce an SES effect on a discrimination learning task given to different Ss reduces the cogency of this interpretation. Although the research of Amster and Marascuilo (1965) confirm the findings reported by Scholnik and Osler (1968), a study conducted by Fang (1966) is contradictory. In the Fang (1966) study, middle SES seventh and eighth graders excelled the lower SES children in speed of concept formation. However, the middle and low SES groups in this investigation were selected from the upper 27% and lower 27% of the distribution of the population. Consequently, the findings are generalizable to only the members of the population with extremely high or extremely low SES characteristics. In conclusion, when the entire SES distribution has been used, SES does not appear to account for a significant portion of variance in concept attainment.

It should be noted that Zigler and DeLabry (1962) found that middle SES children were superior to low SES Ss on a concept-switching task. On this task all Ss learned a first concept and then were required to learn a second concept using the same materials. Speed of learning the second concept was the dependent variable. The Ss were about 6 years old. Since the concept-switching task has been shown to be affected by different variables than the simple concept formation task (Wolff, 1967), these tasks are considered to be qualitatively different. Consequently, it is reasonable to say that Zigler and DeLabry's (1962) findings do not contradict the conclusion that SES has negligible effect on concept formation.

A recurrent theme in contemporary discussions of learning and instruction is that teaching procedures should be tailored to the cognitive capabilities of the learner. It is reasoned that since different individuals manifest differing profiles of learning ability, the success of a given instructional strategy will depend on the extent to which it is accommodated to the intellectual characteristics of the student. For example, Jensen (1969) asserts that "educational researchers must discover and devise teaching methods that capitalize on existing abilities for the acquisition of those basic skills which students will need." (p. 117) Support for this position is provided by Cronbach (1969) who urges that "new kinds of instruction be developed to fit diverse patterns of ability . . . The undoubted significance of heredity must not deter researchers from trying to design procedures to do this. Impossible things are happening every day." (p. 347).

It is apparent from the discussion at the outset of this paper that children of low socioeconomic status have different patterns of cognitive capability than children of middle socioeconomic status. That is, the level of abstract verbal functioning as measured by tests of intelligence and vocabulary, is markedly higher for middle SES than for low SES children. However, the basic associative learning ability, which is indexed by paired associate and concept formation tasks, is not different for these two SES groups.

The primary issue to which this study addresses itself is whether different forms of instruction are differentially effective for low and middle SES children. For example, it is possible that a method of

instruction which relies on abstract verbal functioning will be more effective for middle SES children than low SES children since the former possess higher IQs. On the other hand, instruction which depends on basic associative learning ability may be equally effective for both the middle and low SES groups since the two groups do not differ on this dimension of ability. Furthermore, it is possible, though not too likely, that low SES children will learn more rapidly under instructional conditions requiring basic associative ability than under conditions requiring abstract verbal functioning. Conversely, middle SES children may learn more rapidly from instruction which demands abstract verbal functioning than instruction which relies on basic associative learning ability.

The second purpose of the study was to investigate further the effects of instructional variables studied previously by Guthrie and Baldwin (1969). One result obtained from the previous experiment was that there was no transfer from a learning task to a similar mastery test. The learning task required Ss to produce instances of a language concept in isolation orally. Feedback was provided on every trial. The mastery test required the oral production of sentences which contained instances of the concept. No feedback was provided. The Ss who attained criterion on the learning task were no more successful on the mastery test than Ss who took the mastery test with no prior exposure to the learning task.

Performance on the mastery test was considered to be educationally significant. On the contrary, learning to perform the learning task has practical significance only if such learning transfers to the

mastery test. It is necessary therefore to identify a learning task the mastery of which will produce successful performance on the mastery test. Toward this end, it was considered desirable to identify a learning task that was highly similar to the mastery test. Consequently, the criterion concept formation task for the present study was the production of sentences which contain instances of the concept. This learning task was identical to the mastery test except that feedback was omitted from the latter.

In the previous investigation, the presentation of a rule had no effect on the concept formation task. However, the instructional treatment including both rule and rule application training facilitated learning significantly. The final issue of interest was whether these instructional variables would have the same effects on the complex concept formation task as they did on the simpler one.

Method

Subjects. The original sample consisted of 96 Negro children drawn from the fifth- and sixth-grade classes of three schools. Of this original group, 21 Ss were dropped: 16 Ss failed one of the experimental tasks and 5 Ss were eliminated at random from several of the treatment conditions to create equal numbers of Ss in every condition in order to facilitate the analysis of variance. The final sample of 75 Ss included 32 boys and 43 girls. The mean Kuhlmann-Anderson IQ of the group was 103.23 and the standard deviation was 10.46; the median IQ was 104.50. The mean IQ of the Ss above the median was 112.00 with a standard deviation of 5.62; the mean of the low IQ group was 95.56 and the standard deviation was 7.12.

The socioeconomic status (SES) of the Ss was determined with the Hollingshead occupational scale (Hollingshead & Redlich, 1958). The seven levels of the scale include: (a) executives and proprietors of large concerns, and major professionals; (b) managers and proprietors of medium-sized businesses and lesser professionals; (c) administrative personnel of large concerns, owners of small independent businesses and semi-professionals; (d) owners of little businesses, clerical and sales workers, and technicians; (e) skilled workers; (f) semi-skilled workers; and (g) unskilled workers. The Ss who had one or more breadwinners in the family at level (d) or higher were classified as high SES, whereas other Ss were designated as low SES. The experimental design was a 5x2x2 factorial including 5 treatment conditions, 2 levels of IQ, and 2 levels of socioeconomic status. After the Ss had been identified as members of one of the four categories which resulted from combining the 2 levels of the two classificatory variables, IQ and SES, the Ss were randomly assigned to one of the 5 treatment conditions.

Experimental Tasks. A number of instructional sequences were constructed and their effectiveness was compared. These instructional sequences were composed of various combinations of experimental tasks. The critical words used in each task were drawn from a list of 172 vowel-initial and 108 consonant-initial nouns or noun phrases. The words were drawn randomly without replacement from the list for each task. The experimental tasks are described in detail in the Appendix.

1. Vowel-consonant discrimination. English words were presented to Ss successively with a tape recorder. A total of 40 words was arranged in blocks of 4. Each block included 2 consonant-initial words

and 2 vowel-initial words occurring in random order. The Ss labeled each word as beginning with a vowel or consonant, and E provided feedback of yes or no following each response. The task was discontinued following the attainment of the criterion of eight consecutive correct responses or the completion of 40 trials. Any subject who failed to attain criterion was replaced by another S selected at random.

2. Rule verbalization. The following rule was read to the S by E: "After the word the, K comes before consonants and T comes before vowels." Next, the first nine words of the rule were read by E and S completed the statement of the rule aloud. The portion of the rule read by E was reduced and the portion of the rule verbalized by S was increased until S verbalized the entire rule twice correctly.

3. Rule application. The application task was initiated by presenting a stimulus to S. The stimulus was either a single critical word or a sentence and a critical word which was to be substituted for another word in the sentence. The first step was to ask S whether the critical word began with a vowel or a consonant. Second, S was required to verbalize the portion of the rule which assigned a response (i.e., K or T, to words with the type of sound identified in the first step). Third, the stimulus was presented again and S was requested to produce a composite oral response which included both the critical word and the appropriate consonant. When the application task was intended to make the rule applicable to the production of instances (task 4), the stimulus was a single critical word; whereas when the application task was intended to make the rule applicable to sentence substitution

(task 5), the stimulus was a sentence with instructions to substitute the given critical word for a word in the sentence. The stimuli used in the two forms of the application task were the same as those used in tasks 4 and 5.

All of the steps in the application procedure were administered until S made correct responses at step three on three successive trials. Then step two was omitted from the procedure until S attained correct responses at step three for three successive trials. Next steps one and two were omitted and step three was presented alone for one trial. At this point the stimuli were presented successively until S attained criterion or completed all of the trials in the task.

Throughout the administration of this task, feedback consisting of "No, try again," was provided following errors on steps one or two. No feedback was given following correct responses. The feedback given for the third step was yes following correct responses and no plus the correct response following errors.

4. Production of instances. Words, which included only nouns or noun phrases, were presented one at a time to Ss with a tape recorder, and the Ss responded by saying K or T and then saying the word. For example, given the word apron, S responded T apron; and given fireman, S said K fireman. A total of 60 words were available, half of them vowel-initial and half consonant-initial words. In every block of three words, at least one word of each type was included. Feedback, consisting of yes following correct responses and no following incorrect responses, was provided on every trial. The Ss were run to a criterion of twelve consecutive correct responses or the limit of 60

trials. All Ss who were given this task were required to attain criterion before progressing to the next task. One S failed to reach criterion before the limit of 60 trials and was replaced by another S at random.

5. Sentence substitution. On each trial in this task, a sentence was presented which contained the letter K or T preceding a noun or noun phrase. Following the presentation of the sentence, Ss were instructed to substitute a given noun for the noun in the sentence which followed the consonant K or T. S responded by saying the sentence with the new word preceded by the appropriate consonant. For example, S was given the following stimulus: "That girl was the K girl scout. Change girl scout to outlaw." S was then expected to respond by saying: "That girl was the T outlaw." After each response, S was given feedback consisting of yes following correct responses, and no plus the presentation of the correct response following errors.

A total of 72 sentences were available for tape recorded presentation. The sentences were arranged in blocks of six, each block including an equal number of vowel-initial and consonant-initial words as the critical words to be substituted into the sentence. In addition, four of the sentences in each block contained a word in the sentence which had a different type of initial phoneme (i.e., vowels vs. consonants) than the critical word. For these sentences, S was required to include in his response a consonant, K or T, which was different from that presented in the original stimulus sentence. Concomitantly, two of the sentences in each block contained a word with the same type of initial phoneme as the critical word. On these sentences, the

correct response required the same consonant (i.e., K or T) as presented in the stimulus sentence. Within each block the occurrences of vowel-initial and consonant-initial critical words and the requirement for the same or different type of consonant in the S's response were determined at random. The criterion for the task was correct responses on all trials in two consecutive blocks of sentences. This criterion insured that all Ss responded correctly on six sentences with consonant-initial critical words and six sentences with a vowel-initial critical word. The criterion also required the production of eight sentences in which the single consonant preceding the critical word was different from the consonant in the stimulus sentence and the production of four sentences where the consonant was the same as that of the stimulus sentence.

6. Mastery test. Twenty-four sentences were presented with a tape recorder. On each sentence, S was required to substitute a given noun or noun phrase for a given noun or noun phrase in the sentence. The task was identical to the sentence substitution task except that no feedback was provided on any trial. The sentences were blocked in groups of six. In each block the types of critical words and the requirements for the production of the consonants T and K preceding the critical words were the same as those of the sentence substitution task. All Ss received all of the sentences.

Treatment Conditions. The treatment conditions were constructed by combining the experimental tasks systematically (see Table 1). Treatment Condition I consisted of all of the following experimental tasks administered successively: the vowel-consonant discrimination

(task 1), rule verbalization (task 2), rule application appropriate for the production of instances (task 3a), production of instances (task 4), sentence substitution (task 5), and the mastery test (task 6). Treatment Condition II was the same as Treatment I except that the production of instances (task 4) was omitted. This change from Treatment I necessitated a modification of the rule application task to render it appropriate for the sentence substitution task (task 5) rather than production of instances (task 4). Treatment Condition III was identical to Treatment II except that the rule application task was excluded. Thus Treatment III included tasks 1, 2, 5, and 6. Treatment IV contained tasks 1, 5, and 6, differing from Treatment III only by the absence of task 2. Finally, Treatment V was composed solely of task 6, the mastery test. This condition provided baseline information on the difficulty of the mastery test with no pretests or training which might affect performance on the test (see Table 1).

TABLE 1

Combination of Experimental Tasks To Form Treatment Conditions

Treatment Conditions	Experimental Tasks					
I	1	2	3a	4	5	6
II	1	2	3b		5	6
III	1	2			5	6
IV	1				5	6
V						6

Note.—1=Vowel-consonant discrimination; 2=Rule verbalization; 3=Rule application (a=appropriate for production of instances; b=appropriate for sentence substitution); 4=Production of instances; 5=Sentence substitution; 6=Mastery test.

Procedure. The experimenters worked individually with each S in a small room in the school the S attended. Both E and S sat at a table on which a Uher taperecorder was placed. All of the materials for tasks 1, 4, 5, and 6 were presented with a tape recorder. The materials for tasks 2 and 3 were read by E, since some individual monitoring of the task was needed for each S. On tasks 1, 4, 5, and 6, E maintained a written record of each response as correct or incorrect. The time spent with each S ranged from approximately 10 minutes for Ss in Treatment Condition V to approximately 35 minutes for Ss in the other treatments.

Results

The trials to criterion on the sentence substitution task were analyzed with a 4x2x2 analysis of variance. The analysis included 4 treatment conditions, 2 levels of student IQ, and 2 levels of socio-economic status (SES). The limit in the sentence substitution task was 72 trials. However, no S who attained criterion on the task required more than 40 trials to meet the criterion. Consequently, the non-learners contributed an extraordinary amount of error variance to the data. To reduce this source of error variance, the nonlearners were assigned a score of 50 rather than their original raw score of 72. These transformed data were then analyzed with the 4x2x2 analysis of variance. The results were that significant main effects were observed for treatment conditions ($F = 23.15$, $df = 3/48$, $p < .001$) and SES ($F = 4.95$, $df = 1/48$, $p < .05$). Neither the main effect for IQ nor any of the interaction effects were significant. See Table 2 for a summary of this analysis and Table 3 for the group means and standard deviations.

TABLE 2

Analysis of Variance of Trials to Criterion
on the Sentence Substitution Task

Source of Variance	SS	df	MS	F
A Treatments	14,827.07	3	4,942.36	23.15**
B IQ	517.56	1	517.56	2.42
C SES	1,056.25	1	1,056.25	4.95*
AB	349.06	3	116.35	< 1
AC	394.87	3	131.62	< 1
BC	361.01	1	361.01	1.69
ABC	398.62	3	132.87	< 1
error	10,246.50	48	213.47	
Total	28,150.94	63		

** $p < .001$

* $p < .05$

TABLE 3

Means and Standard Deviations for Trials to Criterion on Sentence Substitution Task

Treatment Conditions	High IQ				Low IQ			
	High SES		Low SES		High SES		Low SES	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
I	25.75	9.01	23.50	21.80	17.75	19.61	41.75	14.29
II	8.00	8.40	17.75	19.31	9.25	7.76	25.75	24.25
III	1.25	.44	7.25	8.67	11.75	.83	22.75	15.77
IV	50.00	--	50.00	--	50.00	--	50.00	--

It is interesting to note that a 4x2x2 analysis of variance of the raw data yielded virtually identical results to the analysis of the transformed data. That is, significant main effects were attributable to treatment conditions ($F = 26.09$, $df = 3/48$, $p < .001$) and SES ($F = 6.13$, $df = 1/48$, $p < .05$). There was no significant main effect for IQ nor any significant interactions.

The performance of the Ss on the sentence substitution task is displayed graphically in Figure 1. The high SES Ss were noticeably superior to the low SES Ss on all treatment conditions except Treatment Condition IV in which none of the Ss in either group reached criterion. That the difference between the groups is significant is indicated by the analysis of variance (Table 2).

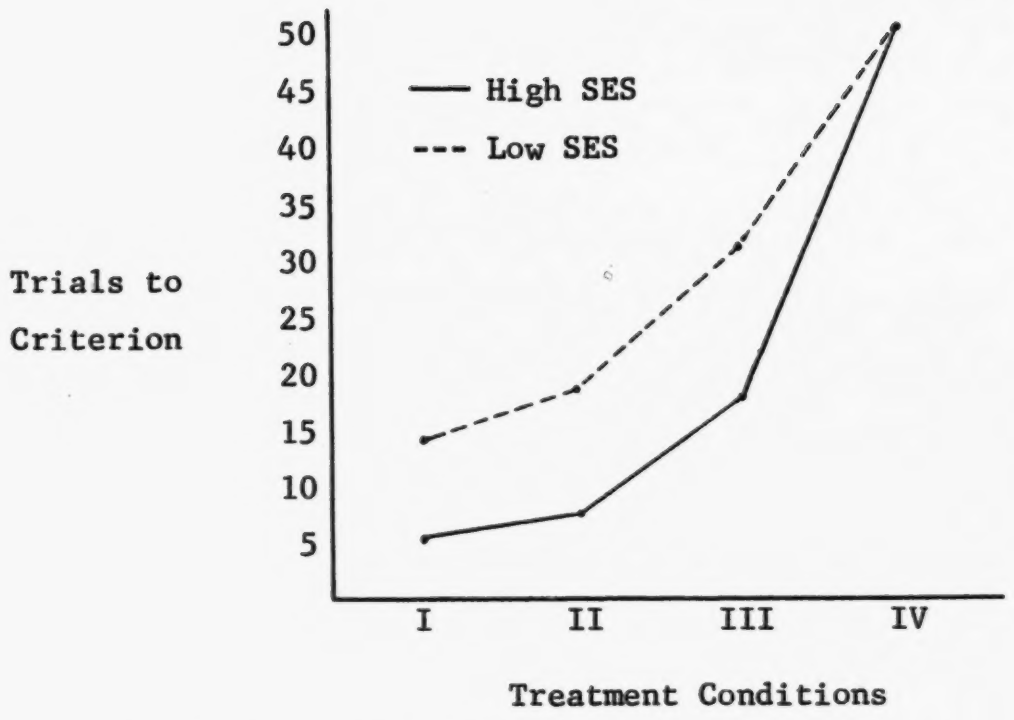

Figure 1. Trials to criterion on the sentence substitution task (task 5) as a function of treatment conditions and SES.

The effectiveness of the individual treatment conditions was analyzed with the Neuman-Keuls procedure for post hoc comparisons (see Table 4). Treatment Conditions I, II, and III are all superior to Treatment IV which contained essentially no training. In Treatment IV only the vowel-consonant discrimination task was administered prior to the sentence substitution task. Since no S in Treatment IV reached criterion, the effect of the vowel-consonant discrimination presented alone was negligible. It is noteworthy that Treatment III which included the rule verbalization task as well as the vowel-consonant discrimination task was superior to Treatment IV which contained only the vowel-consonant discrimination task. Thus, learning to verbalize the rule markedly facilitated learning on the sentence substitution task, provided that the vowel-consonant discrimination task was mastered. Since no test was made of the effect of the rule

verbalization task in the absence of the vowel-consonant discrimination task, it is impossible to determine whether the effect of the rule verbalization is a main effect or an effect of the interaction between the rule verbalization and the presence of the vowel-consonant discrimination task. However, the rule contains the words vowel and consonant; a task analysis of the sentence substitution task indicates that the discrimination learned in the vowel-consonant discrimination task is required for mastery on the sentence substitution task. Consequently, it is highly likely that the rule verbalization would have little effect in the absence of mastery of the vowel-consonant discrimination. However, an empirical study is needed to verify this interpretation of the effect of rule verbalization.

TABLE 4

Differences among Treatment Conditions on the Sentence Substitution Task

Treatment Conditions	Experimental Tasks						Mean Trials to Crit. on Sentence Substit.Task	Significant Differences
I	1	2	3a	4	5	6	10.75	|
II	1	2	3b		5	6	15.19	|
III	1	2			5	6	27.19	
IV	1				5	6	50.00	

Note. —The treatment conditions connected by a line in the column labeled "Significant Differences" do not differ. All other differences are significant beyond the .05 level.

Treatment Condition II was found to be superior to Treatment III. Since Treatment II included the rule application task in addition to the rule verbalization task whereas Treatment III contained only the rule verbalization task, the effect is attributable to this application task. The question of whether this effect could have occurred without having been preceded by the rule verbalization task does not arise since the act of verbalizing the rule is an indispensible step in the rule application procedure. The application of the rule cannot exist without the prior verbalization of the rule.

Treatment Condition II, which included the rule verbalization task and rule application task which was appropriate for the sentence substitution task, was not significantly different from Treatment Condition I. Treatment I contained the task which required Ss to produce instances of the concept in isolation (task 4) and this task was preceded by the rule verbalization task and the rule application task appropriate for the production of instances. Since the rule application task in Treatments I and II differ slightly, these treatments do not bear the same relationship as Treatments II and III and Treatments III and IV. In the latter two pair of treatments the treatment with the lower Roman numeral contains a number of tasks which include one task not found in the treatment with the higher Roman numeral. Treatment I differs from Treatment II, however, not only in the addition of the task requiring the production of instances but also a modification of the rule application task. Thus Treatments I and II contain two distinct differences rather than one. The lack of difference between these treatments is not easily attributable to a ceiling effect in the criterion measure since there is no sizable

correlation between the means and variances of these groups. The two instructional sequences should be regarded as equally efficient methods for imparting the capability of orally producing whole sentences which contain a novel, difficult grammatical concept, provided, of course, that the ability to produce the phonological sequence is present.

The mastery test scores were analyzed with a 3x2x2 unweighted means analysis of variance. The first factor was training which included three levels consisting of those Ss who attained criterion on the sentence substitution task (learners), those Ss who failed to attain criterion on the sentence substitution task (nonlearners), and those Ss who took the mastery test without performing any of the experimental tasks (no training). The second factor was student IQ with levels of high and low, and the third factor was SES with levels of high and low. The outcome of the analysis was a significant main effect for training ($F = 64.76$, $df = 2/63$, $p < .001$) a significant effect for IQ ($F = 7.63$, $df = 1/63$, $p < .01$), and an interaction between training and IQ ($F = 5.55$, $df = 2/63$, $p < .05$). None of the other effects were significant (see Table 5).

A post hoc inspection of the training x IQ interaction using the Scheffe procedure (McNemar, 1962) revealed that among the learners and nonlearners, the two IQ groups did not differ. However, in the no training group, the high IQ Ss surpassed the low IQ Ss ($F = 3.45$, $df = 5/10$, $.05 < p < .10$) (see Figure 2).

The mean number of items correct on the mastery test for the learners was 22.82. Considering that there were only 24 items on the test, this mean is remarkably high. In fact, 85% of all of the learners

TABLE 5

Analysis of Variance of Mastery Test Scores

Source of Variance	SS	df	MS	F
A Training	979.37	2	489.68	64.76***
B IQ	58.79	1	58.79	7.63**
C SES	.04	1	.04	< 1
AB	85.50	2	42.75	5.55*
AC	27.59	2	13.79	1.79 ns
BC	6.76	1	6.76	< 1
ABC	.68	2	.34	< 1
error	485.26	63	7.70	
Total	1,643.99	74		

*** $p < .001$
** $p < .01$
* $p < .05$

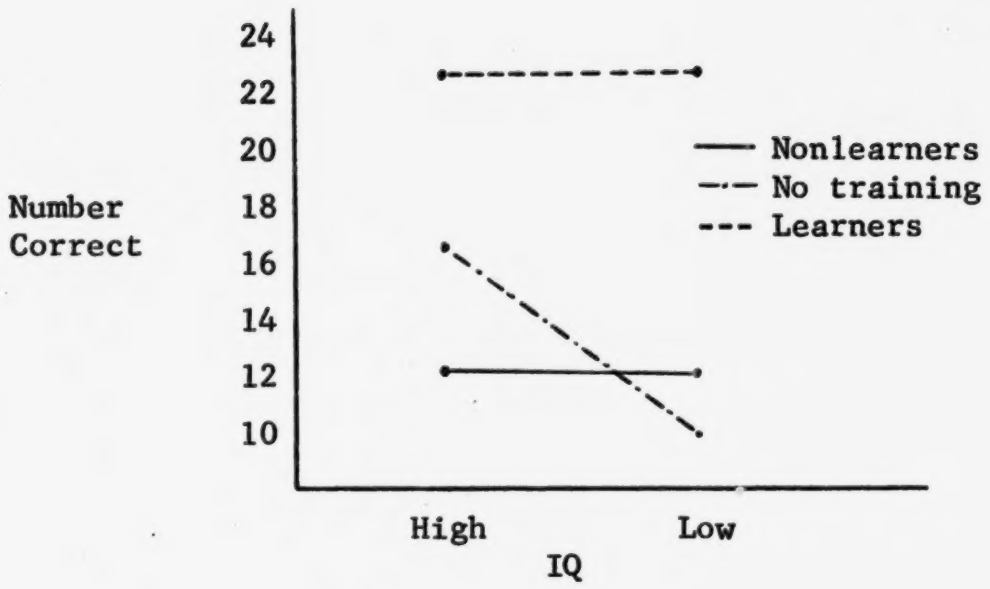

Figure 2. Mean number correct on the mastery test as a function of training and student IQ.

equaled or exceeded a score of 22 on the mastery test which is 92% of the total number of possible items. On the other hand, the mean of the nonlearners was 12.96 and the mean of the no training group was 11.82. These scores do not appear to differ from each other and both are inferior to the mean for the learners. That is, the learners surpassed the nonlearners ($F = 14.02$, $df = 5/60$, $p < .01$); and the learners surpassed the no training group ($F = 11.00$, $df = 5/34$, $p < .01$). Finally, the reliability of the mastery test according to the Kuder-Richardson 21 formula was .91.

Discussion

With regard to the variable of socioeconomic status, the results were surprising. Middle SES children were superior to the low SES children under all of the instructional conditions except for the no training condition which consisted of practice on the criterion task.

There was no interaction between instruction and SES which suggests that the same forms of instruction which are effective for middle SES children are also effective for low SES children.

It was suggested at the outset that since SES is correlated with IQ, instruction which appears to rely heavily on a substantial level of IQ might be more effective for high SES than low SES Ss. The result was that this hypothesis was confirmed. Instruction using abstract verbal rules was more effective for high than low SES Ss. However, this difference cannot be attributed to differences in the IQ's of the two SES groups, since IQ was a factor in the study, and the high and low IQ groups did not differ in their performance under any of the instructional treatments.

It is possible that the SES effect is due to the difference between the two SES groups in motivation, i.e., effort, attention, and perseverence, rather than cognitive capabilities. Evidence for this interpretation is furnished by a study by Marshall (1969) which indicated that middle and low SES groups did not differ in learning an exciting, novel task which was interesting to both groups. On a low-interest task, however, the low SES group performed worse than they had on the high interest task, and the high SES group performed better than they had on the high interest task. In other words, a highly interesting task facilitated performance for the low SES Ss and impaired the performance of the middle SES group. If the task in the present study had been of greater intrinsic interest to the Ss, the SES effect may have been reduced or eliminated.

Further evidence for the motivational interpretation of these results is derived from research which indicates that different types of feedback and reinforcement are differentially effective for children from 5 to 9 years old from low and middle SES groups (Zigler & DeLabry, 1962; Zigler & Kanzer, 1962; Marshall, 1969). The use of praise and tangible reinforcers such as toys facilitate learning in low SES children more than feedback consisting of information regarding the correctness of their responses. On the other hand, for middle SES children informational feedback is more effective than tangible reinforcers or praise. Since the present study included the provision of informational feedback with no supplementary tangible reinforcers or praise, it is likely that the low SES Ss were not investing as much effort and attention in the task as the middle SES Ss.

It is possible that the SES effect is attributable to the specific nature of the stimuli and responses used in this study. The stimuli used here were auditory and verbal whereas the stimuli used in other studies have usually been visual and geometric. The responses required here were the oral production of sentences whereas other studies have usually required simple, one-word verbal responses or simple psychomotor sorting behavior. It is possible that these differences account for the fact that an SES effect was obtained here and not obtained elsewhere. However, the structural similarity of this task and the tasks used in other studies reduces the plausibility of this interpretation.

The concept formation task used in this study conforms to the general concept formation paradigm except that the S was required to reproduce the stimulus in addition to producing a response to the

stimulus. That is, the S was presented a sentence and a word to be substituted into the sentence. The S then reproduced the sentence including the new word and including the critical response, i.e., the appropriate consonant K or T, before the critical word. One of the responses, T, was associated with a large class of stimuli, i.e., vowel-initial words, and the other response, K, was associated with a different class of stimuli, i.e., consonant-initial words. This relationship between the stimuli and the responses renders this task as a member of the general concept formation paradigm. Thus, on the basis of formal structure, this task does not differ from tasks used in previous studies of concept learning. The relationship between the task used in this study and the general concept formation paradigm is described in detail in the report by Guthrie and Baldwin (1969).

The effects of the instructional treatment conditions were clear and unequivocal. They did not interact with either of the classificatory variables of IQ or SES. The rule verbalization treatment was superior to the treatment containing no rule. This result does not completely replicate the finding in a prior study employing the same variables (Guthrie & Baldwin, 1969). Previously, the rule treatment produced no facilitation on the concept formation task. One plausible explanation for these apparently conflicting results is that the difficulty of the concept formation task in the two studies was different. In the previous experiment (Guthrie & Baldwin, 1969), the task contained a maximum of 78 trials. The average number of trials required to reach criterion for the Ss who received no training on this task was 38.25. However, when no training was provided on the concept formation task in

this study, none of the Ss demonstrated any evidence of learning. Consequently, it appears that on the easier task, i.e., when the task could be easily learned with no instruction, the provision of a rule did not affect performance. However, when the task was extremely difficult, the provision of the rule significantly improved learning.

The treatment condition which included both rule application and rule verbalization training was superior to the treatment which included only rule verbalization training. This result replicates the same finding in the previous study (Guthrie & Baldwin, 1969). The fact that the rule application training produced unambiguous facilitative effects in two experiments and the fact that these effects were observed for Ss regardless of their IQ's or socioeconomic status indicates the breadth and power of this variable.

The Ss who learned to produce instances of the concept in isolation were significantly better on the criterion concept formation task than Ss who had no training prior to the criterion task. The criterion concept formation task required the oral production of sentences containing an instance of the concept with feedback provided on every trial. It is interesting that in the previous investigation (Guthrie & Baldwin, 1969) the ability to produce instances of the concept in isolation had no effect on the mastery test which required oral production of sentences with no feedback. In other words, the ability to produce instances of a concept in isolation facilitates learning on the criterion task when feedback is present, but does not facilitate performance on the task when feedback is absent.

The mastery test results indicated that the Ss who attained criterion on the concept formation task (learners) were superior to the Ss who failed to attain criterion (nonlearners). Furthermore, the nonlearners did not perform differently on the mastery test than the Ss who had no training at all on the concept formation task. This finding indicates that large amounts of practice on a task and exposure to the material do not enhance performance on the task unless there is some evidence that the practice is producing a permanent behavioral change, i.e., learning. Thus, it appears that regardless of the type or amount of instruction which is provided prior to the administration of the criterion task, learning on the criterion task must be present if performance on the mastery test is to be facilitated.

The interaction between the factors of learning and IQ in the analysis of variance on the mastery test scores appears to be an artifact of the instructions given to the Ss who received no experimental tasks prior to the mastery test. Although the same instructions for the mastery test were given to all Ss, the no training group had not been previously exposed to the type of task present in the mastery test. In the instructions one example item was provided which was similar to 67% of the items on the mastery test. The high IQ Ss appeared to generalize the example to the entire test and thus performed better than chance which was 50%. The low IQ Ss, however, exhibited no such generalization and their performance approximated the chance level of 50%.

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APPENDIX A

Experimental Tasks

1. Vowel-Consonant Discrimination (Criterion 8)

Instruction: I will say a word. You tell me if it begins with a vowel or consonant. (Feedback yes/no after each subject response.)

Right	Wrong	Right	Wrong
army		alphabet	
battleship		wagon	
desk		question	
invitation		ape	
girl scout		Eskimo	
mystery		zebra	
empty		radio	
undershirt		armchair	
eye		year	
champion		explosion	
anchor		evening	
hiding place		buckle	
eraser		lion	
vacation		moustache	
joke		arrow	
island		entrance	

1. Vowel-Consonant Discrimination (Criterion 8) -- Continued

Right	Wrong	Right	Wrong
walk		goldfish	
policeman		ink	
outlaw		pocket	
umbrella		uncle	

2. Rule Verbalization

Instruction: Here is a rule about how the sounds Kay and Tee will be used in sentences:

(a) After the word the,

(b) kay comes before consonants, and

(c) tee comes before vowels.

Now I will say part of the rule, and you fill in what's missing.

E says	S says
a b c	
a b	c
a	b c
Now say the whole rule	a b c
Say it again	a b c

If S errs, provide correct response and repeat step.

3a. Rule Application to Production

Instruction: Now we'll see how the rule is used to say phrases like T apple or K glass. I'll say a word like apple; you say either T apple or K apple, whichever you think is correct.

Here is a word: orange.

1. Does orange begin with a vowel or consonant?
2. What comes before words that begin with _____?
3. If I said orange, you would say _____?

1, 2, 3 - 2 correct

1, 3 - 3 correct

3 - 1 trial

3b. Rule Application to Sentences

Rule Treatment

Instruction: Now we'll see how the rule is used to say sentences.

If I said: "He hit the K dog, change dog to elephant,"

you would say, "He hit the T elephant."

"He hit the K dog." Change dog to elephant.

1. Does elephant begin with a vowel or consonant?
2. What comes before words that begin with _____?
3. If I said, "He hit the K dog, change dog to elephant," you would say _____?

(yes/no - repeat with correct response)

1, 2, 3 - 3 correct

1, 3 - 3 correct

3 - 1 trial

4. Production of Instances (Criterion 12)

(feedback: yes/no)

	Right	Wrong		Right	Wrong
bicycle	k		wagon	k	
cabinet	k		toy	k	
operator	t		empty room	t	
card	k		inch	t	
ocean	t		zero	k	
understanding	t		afternoon	t	
mystery	k		kangaroo	k	
astronaut	t		oyster	t	
elephant	t		pad	k	
dog	k		ugly picture	t	
cat	k		leaf	k	
oil can	t		insider	t	
adventure	t		mess	k	
jar	k		arrow	t	
odor	t		explosion	t	

4. Production of Instances (Criterion 12) -- Continued

	Right	Wrong		Right	Wrong
judge	k		vacation	k	
fireman	k		owl	t	
armchair	t		igloo	t	
insult	t		aspirin	t	
organ	t		key	k	
grocery store	k		Eskimo	t	
appliance	t		interruption	t	
lock	k		row boat	k	
heel	k		attic	t	
undershirt	t		ear	t	
dish	k		pencil	k	
apron	t		song	k	
ash tray	t		policeman	k	
verb	k		auditorium	t	
zoo	k		evening	t	

5. Sentence Substitution (criterion 2 blocks)

(Feedback yes/no, give response)

	Right	Wrong
1. She wrote the k note for him. (answer)		
2. Mr. Jones was the k champion. (underdog)		
3. A squirrel swallowed the t acorn. (aspirin)		
4. The t apron was covering her head. (net)		
5. His dog ran toward the t elm tree. (jet plane)		
6. His answer was the k verb. (quote)		
7. We enjoyed the t amusements. (acrobats)		
8. Her mother wanted to work in the k kitchen. (elevator)		
9. They were walking in the k zoo. (store)		
10. He built the t estate for his daughter. (kingdom)		
11. He was wearing the t undershirt. (bandage)		
12. The k person could not have lived. (alcoholic)		
13. Those boy scouts slept under the t overpass. (tent)		
14. He worked on the t improvement. (understanding)		
15. The k letter was torn. (dollar)		
16. He was the k deputy. (actor)		
17. Those babies are listening to the t owl. (song)		
18. His teacher gave him the k sentence. (imitation)		

5. Sentence Substitution (criterion 2 blocks) -- Continued

	Right	Wrong
19. The t object was turned upside-down. (wagon)		
20. The t ear was black and blue. (elbow)		
21. His dog made the t uproar. (mess)		
22. The k desk fell on his foot. (organ)		
23. The k leaf fell quickly. (ink bottle)		
24. Barbara was frightened by the k judge. (lion)		
25. The k faucet was dripping. (sink)		
26. She thought she saw the k miracle. (army)		
27. Thomas threw the t icicle over there. (lasso)		
28. He laughed at the t announcement. (joke)		
29. The t elephant was dead. (ox)		
30. The k vacation was short. (oath)		
31. The k foot was broken. (tail)		
32. He put the k lock on his motorcycle. (antenna)		
33. He put the t iron on his shoe. (heel)		
34. He wanted to shoot the k duck. (outlaw)		
35. Everyone heard the t explanation. (invitation)		
36. Elizabeth stayed for the t evening. (day)		

5. Sentence Substitution (criterion 2 blocks) -- Continued

	Right	Wrong
37. The t insider lifted his head. (grown-up)		
38. He could not understand the t order. (insult)		
39. She saw the k fountain yesterday. (insect)		
40. The k flood was outdoors. (obstacle)		
41. Jack swung the t axe. (baseball bat)		
42. Joseph saw the k queen. (zebra)		
43. The k walk was good for Gloria. (rest)		
44. He brought the k horn. (Italian horn)		
45. The k rocket was completely burned, (antique)		
46. He found the t orange in his shoe. (buckle)		
47. The t afternoon was warm. (ocean)		
48. He drew the t advertisement. (cartoon)		
49. The t infant was born. (ape)		
50. They showed the k washer on television. (eagle)		
51. The k branch hurt him. (landslide)		
52. Mary was in the t exchange. (quarrel)		
53. My cat was sleeping in the k garage. (arm chair)		
54. A fire started in the t oven. (classroom)		

5. Sentence Substitution (criterion 2 blocks) -- Continued

	Right	Wrong
55. The t oil can is upstairs. (hiding place)		
56. He lifted the k pack. (tea bag)		
57. They played on the t island. (uneven field)		
58. He never liked the t exercise. (man)		
59. The k noise surprised Rudolph. (arrow)		
60. My sister did not like the k vegetable. (idea)		
61. She measured the t angle. (collar)		
62. We heard the k yell. (radio)		
63. The k kangaroo was eating leaves. (animal)		
64. A truck crashed into the k grocery store. (anchor)		
65. Robert is the t uncle. (policeman)		
66. He went into the t entrance. (alley)		
67. Henry wore the t eye glasses. (sun glasses)		
68. The t adventure was yesterday. (injury)		
69. He was looking at the k jar. (ant hill)		
70. She saw the k frown on his face. (ugly frown)		
71. That barber gave my brother the t apology. (haircut)		
72. The k scratch was on his arm. (blood)		

6. Mastery Test (no feedback)

	Right	Wrong
1. She was working in the k garage. (classroom)		
2. They rode in the t airplane. (truck)		
3. He played the k hero. (infant)		
4. Her mother saw the t Eskimo. (earthworm)		
5. Tommy made the t error. (mistake)		
6. Sam chased the t Indian. (dog)		
7. Mary ran into the k kitchen. (drug store)		
8. His cat swallowed the k goldfish. (eraser)		
9. That is the t uncomfortable chair. (comfortable)		
10. A man threw the k tomato. (egg)		
11. The t ice disappeared. (island)		
12. That girl was the k girl scout. (outlaw)		
13. She reached for the k collar. (buckle)		
14. She made the t improvement. (radio)		
15. He heard the k sound. (echo)		
16. The t occasion was exciting. (escape)		
17. The k fire was last night. (explosion)		
18. Mary bought the k mask. (iron)		
19. We had the k discussion. (argument)		
20. We built the t elevator. (overpass)		
21. I read the t adventure story. (mystery)		
22. Henry opened the t oven. (trap)		
23. They travelled in the k boxcar. (wagon)		
24. He asked for the t envelope. (pencil)		